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(54) [TITLE OF THE INVENTION]
Thin film pattern forming method and thin film pattern forming device

(71) Applicant 000002185
Sony Corporations
7-35, 6-chome, Kita Shinagawa, Shinagawa-ku, Tokyo

(72) Inventor
Mitsunori UEDA
c/o Sony Corporations
7-35, 6-chome, Kita Shinagawa, Shinagawa-ku, Tokyo

(72) Inventor
Junichi DAIHAKU
Same as the above

(74) Agent
Yoichiro FUJISHIMA, patent agent

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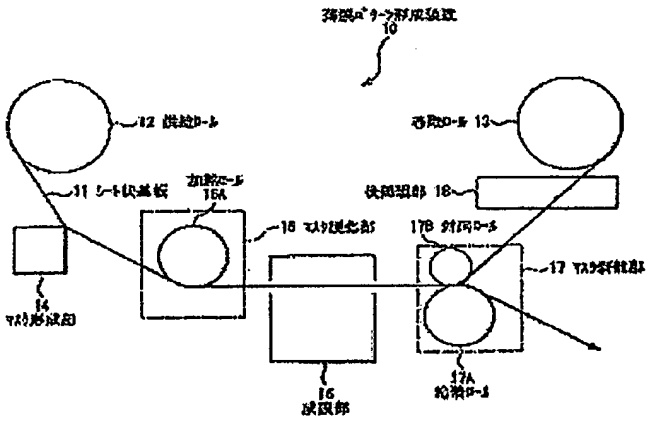
[Note: All names, addresses, company names, and brand names are translated in the most common manner. Japanese language does not have singular or plural words unless otherwise specified with numeral prefix or general form of plurality suffix. Translator's note]

(57) [ABSTRACT]
[SUBJECT]
It offers thin film pattern forming method that is capable of forming a large area and in a large quantity of fine thin film pattern with several 10s nm or lower on a flexible sheet-form substrate.

[MEANS OF SOLUTION]
At a mask forming part (14), a mask is formed on a sheet-form substrate (11) that is sent from a feed roll (12) by coating a releasable resin (for instance, acryl resin) by using printing technology, for instance, an ink jet printing method. After curing this mask at a mask curing part (15), a thin film is formed over an entire plane at film forming part (16). According to the thin film of this time, because mask thickness is thicker than that of thin film, stepping is formed between a portion on a mask pattern and pattern. Mask is released from the sheet-form substrate (11) at mask release part (17) after said thin film is formed. Through this, thin film pattern that is of a negative-type against mask is formed.

(10) thin film pattern forming device, (11) sheet-form substrate, (12) feed roll, (13) take-up roll, (14) mask forming part, (15) mask curing part, (15A) heating roll, (16) film forming part, (17) mask release part, (17A) pressure-sensitive adhesive roll, (17B) opposed roll, (18) post-processing part,



[CLAIMS]

[CLAIM ITEM 1]

A thin film pattern forming method is characterized by the fact that includes a transport process that transports a sheet-form substrate, a mask forming process that forms a mask through selectively coating a resin that is releasable against said sheet-form substrate that is being transported, a thin film forming process that forms prescribed thin film over the entire plane of sheet-form substrate that includes said mask, and mask release process to form a thin film pattern through selectively releasing said mask from said sheet-form substrate.

[CLAIM ITEM 2]

The thin film forming method that is described in the claim item 1, wherein said transport process is carried out by sending out a sheet-form substrate that is coiled in a roll form at one side and taking this up in a roll form at the other side.

[CLAIM ITEM 3]

The thin film forming method that is described in the claim item 1, wherein further includes a process to cure said resin after forming said mask of resin.

[CLAIM ITEM 4]

The thin film forming method that is described in the claim item 1, wherein said mask forming process, thin film forming process and mask release process are repeated for plural number of times each to form a device showing a three-dimensional laminate structure.

[CLAIM ITEM 5]

A thin film pattern forming method is characterized by the fact that includes a transport process that transports a sheet-form substrate, a thin film forming process that forms prescribed thin film over the entire plane of said sheet-form substrate that is being transported, a mask forming process that forms a mask by selectively coating a releasable resin on said thin film, and a thin film etching process that forms thin film pattern by selectively removing said thin film using said mask.

[CLAIM ITEM 6]

The thin film pattern forming method that is described in the claim item 5, wherein said transport process is carried out by sending a sheet-form substrate that is coiled in a roll form at one side and taking this up in a roll form at the other side.

[CLAIM ITEM 7]

The thin film pattern forming method that is described in the claim item 5, wherein further includes a process to cure said resin after forming said mask of resin.

[CLAIM ITEM 8]
The thin film pattern forming method that is described in the claim item 5, wherein said thin film forming process, mask forming process, and thin film etching process are repeated for plural number of times each to form a device showing a three-dimensional laminate structure.

[CLAIM ITEM 9]
A thin film pattern forming device is characterized by the fact that includes transport means that transports said sheet-form substrate by sending out sheet-form substrate that is coiled in a roll form at one side and taking this up in a roll form at the other side, a mask forming means that forms a mask by selectively coating a releasable resin on said sheet-form substrate that is being transported, a thin film forming means that forms prescribed thin film over the entire plane of sheet-form substrate that includes said mask, and mask release means that forms thin film by selectively releasing resin as said mask from said sheet-form substrate.

[CLAIM ITEM 10]
The thin film forming device that is described in the claim item 9, wherein said mask forming means forms pattern of resin by using an ink jet printing method, a gravure printing method, or an off-set printing method.

[CLAIM ITEM 11]
The thin film forming device that is described in the claim item 9, wherein said thin film forming means forms thin film by vacuum thin film forming technologies including a vacuum vapor deposition method, a sputtering method, and a CVD method, or a spin coating method.

[CLAIM ITEM 12]
A thin film pattern forming device is characterized by the fact that includes transport means that transports said sheet-form substrate by sending out a sheet-form substrate that is coiled in a roll form at one side and taking this up in a roll form at the other side, a thin film forming means that forms prescribed thin film over the entire plane of said sheet-form substrate that is being transported, a mask forming means that forms a mask by selectively coating a releasable resin on said thin film, and thin film etching means that forms thin film pattern by selectively removing said thin film by using said mask.

[CLAIM ITEM 13]
The thin film pattern forming device that is described in the claim item 12, wherein said thin film forming means forms thin film by vacuum thin film forming technologies including a vacuum vapor deposition method, a sputtering method, and a CVD method, or a spin coating method.

[CLAIM ITEM 14]
The thin film pattern forming device that is described in the claim item 12, wherein said mask forming means forms a pattern of resin by using an ink jet printing method, a gravure printing method, or an off-set printing method.

[DETAILED EXPLANATION OF THE INVENTION]

[0001]

[TECHNICAL FIELDS OF THIS INVENTION]

This invention relates to a forming method of thin film pattern for purpose of forming a thin film that is used for organic EL (Electroluminescence) display and the like, and a thin film pattern forming device.

[0002]

[PRIOR ART]

According to a manufacturing of semiconductor device in general, it has been carried out by forming of fine pattern device on a substrate of crystal such as silicon (Si) through coating either a negative-type or positive-type photoresist (photosensitive resin) with a spinner, and by exposing and developing this photoresist with a stepper to form a resist mask, and then, by film forming through a vacuum vapor deposition method, a sputtering method, or a CVD (chemical Vapor Deposition) method, or repeating thin film etching that has been formed prior to mask forming. Precision and fineness of the thin film pattern that is formed in above-explained manner are currently at such level that cannot be realized by other methods. This method places its premise on a single wafer processing that processes substrate one sheet at a time; and current mainstream of the substrate is 8 inch size. In addition, TFT (Thin Film Transistor) substrate for a flat display purpose of which enlargement is being targeted is also prepared through use of a single wafer processing that is similar to this method. However, in the case of such single wafer processing method, it presents a problem of high cost.

[0003]

On the one hand, according to organic group semiconductors of which development for display that is prepared through multiple arrays of organic EL (Electroluminescence) elements, a method that utilizes its characteristic of being flexible with such transport means of sending out a substrate in a sheet form that is coiled in a roll form at one end and taking this up thus sent out substrate in a roll form at the other end , and carries out series of processes including mask forming, film forming, etching, and mask removal against substrate all in one time during said transport to form a thin film pattern has been proposed.

[0004]

However, when forming a thin film pattern of organic group semiconductor through such method and when it is attempted to apply a conventional method that exposes pattern on a photoresist at mask forming process, it presents a problem of not being able to form multiple numbers of precise and fine patterns at the same time as it is not possible to carry out an exposure in a continuous manner.

[0005]
Incidentally, it is possible to form such pattern through use of printing techniques such as an ink jet method or a gravure printing method or an off-set printing method and the like. According to this method, the exposure process of photoresist is no longer necessary; and above all, as it shows mass-production capability, an attempt to form a thin film pattern of color filter for purpose of flat panel display has been made. Because film thickness of a color filter is several μm or more , it is possible to control the film thickness sufficiently even with these printing technologies to enable to form stripe-shaped patterns.

[0006]
[SUBJECTS SOLVED BY THIS INVENTION]
However, according to above-explained printing methods, although they are applicable when forming patterns with fair thickness such as a color filter, as it can control the film thickness only to several μm or more, it presents a problem of not possible to apply this as it is for thin film forming of device that requires a film thickness control of several tens of nm or lower such as organic EL display and the like.

[0007]
This invention was arrived based on such problem points; and its purpose is to offer a thin film pattern forming method that is suited for manufacturing or organic EL display and the like with capability of forming fine thin film pattern with several tens nm on a flexible sheet-form substrate over a large area and in a large quantity, and thin film pattern forming device.

[0008]
[MEANS USED TO SOLVE THE SUBJECTS]
The first thin film pattern forming method of this invention includes a transport process that transports a sheet-form substrate, a mask forming process that forms a mask through selectively coating a resin that is releasable against said sheet-form substrate that is being transported, a thin film forming process that forms prescribed thin film over the entire plane of sheet-form substrate that includes said mask, and mask release process that forms negative-type thin film pattern against mask by selectively releasing the resin as the mask from the sheet-form substrate. At this time, it is preferable when transport process is carried out by sending out said sheet-form substrate that is coiled in a roll form at one end and by taking this up in a roll form at the other end.

[0009]
The second thin film pattern forming method of this invention includes a transport process that transports a sheet-form substrate, a thin film forming process that forms prescribed thin film over the entire plane of sheet-form substrate that is being transported, a mask forming process to form a mask by selectively coating a resin that is releasable on the thin film, and mask release process to form positive-type thin film pattern against mask by selectively removing the thin film using the mask.

[0010]
The first thin film pattern forming device of this invention is equipped with a transport means that transports a sheet-form substrate by sending out sheet-form substrate that is coiled in a roll form at one end and by taking this up in a roll form at the other end, a mask forming means that forms a mask by selectively coating a resin that is releasable against sheet-form substrate that is being transported, a this film forming means that forms prescribed thin film over entire plane of sheet-form substrate that includes said mask, and a mask release means that forms negative-type thin film pattern against mask by selectively releasing the resin that is used as a mask from said sheet-form substrate.

[0011]
The second thin film pattern forming device of this invention is equipped with a transport means that transports a sheet-form substrate by sending out sheet-form substrate that is coiled in a roll form at one end and by taking this up in a roll form at the other end, a thin film forming means that forms prescribed thin film over the entire plane of said sheet-form substrate that is being transported, a mask forming means that forms a mask by selectively coating a resin that is releasable on a thin film, and a mask release means that forms positive-type thin film pattern against mask by selectively removing thin film using said mask.

[0012]
According to the first thin film pattern forming method or thin film pattern forming device of this invention, after the releasable resin is selectively coated against sheet-form substrate that is being transported by printing methods such as, for instance, an ink jet method or an off-set method to form a mask, prescribed thin film is formed over entire plane of sheet-form substrate that includes mask, and then, the resin that is used as a mask is selectively released from the sheet-form substrate. Through this, forming of thin film pattern showing several 10s nm or lower becomes possible regardless of film thickness of the mask itself.

[0013]
According to the second thin film pattern forming method or thin film pattern forming device of this invention, prescribed thin film is formed over the entire plane of sheet-form substrate, and then, after forming a mask by selectively coating a releasable resin on the thin film of sheet-form substrate that is being transported through such printing methods as, for instance, an ink jet method or an off-set method, the resin that is used as a mask is selectively released from the sheet-form substrate. Through this, forming of thin film pattern showing several 10s nm or lower becomes possible regardless of film thickness of the mask itself.

[0014]
[IMPLEMENTATION FORMAT OF THIS INVENTION]
Implementation format of this invention is explained below in reference with attached Figures.

[0015]
(FIRST IMPLEMENTATION FORMAT)
Figure 1 illustrates a schematic structure of thin film pattern forming device (10) that relates to the first implementation format of this invention. This thin film pattern forming device (10) is equipped with a feed roll (12) that sends out a flexible sheet-form substrate (11) that is coiled in a roll form, and a take-up roll (13) that takes up thus fed sheet-form substrate (11) in a roll form at the other end. These feed roll (12) and take-up roll (13) are rotated along with later explained rolls of each part at constant speed by a drive source that is not illustrated in this Figure in such manner so each circumferential speed would be mutually synchronized. The sheet-form substrate (11) is formed of plastic such as, for instance, polyethylene terephthalate (PET), polyethylene naphthalate (PEN), or polyether sulfone (PES) and the like. Furthermore, drive source for these feed roll (12) and take-up roll (13) is in correspondence with one specific example of "transport means" of this invention.

[0016]
Followings are arranged between feed roll (12) and take-up roll (13) in the order of sequence explained below: a mask forming part (14) for purpose of forming a mask by a resin on a sheet-form substrate (11) that is fed by the feed roll (12), a mask curing part (15) for purpose of curing resin formed at this mask forming part (14), a film forming part (16) that forms thin film over entire plane of sheet-form substrate (11) that includes mask that is cured at the mask curing part (15), mask release part (17) for purpose of forming thin film pattern by releasing the mask (resin) from the sheet-form substrate (11) on which thin film is formed at this film forming part (16), and post-processing part (18) that post processes sheet-form substrate (11) on which thin film pattern is formed.

[0017]
The mask forming part (14) forms mask by coating (printing) a resin that is releasable from the sheet-form substrate (11) such as acryl resin selectively to give a film thickness of several 100 μm or lower by using, for instance, an ink jet printing device, a gravure printing device, or an off-set printing device. According to this implementation format, it is preferable when this mask thickness is set to be thicker than the thickness of thin film pattern that is formed at the film forming part (16) in order to ease its release (lift off) that is further explained later.

[0018]
The mask curing part (15) cures mask of the resin that is formed at this mask forming part (14) through heating by, for instance, heating roll (15A). Furthermore, it is all right to cure through irradiation of UV (Ultraviolet) rays, or EB (Electron beam) and drying besides explained above.

[0019]
The film forming part (16) forms thin film with prescribed film thickness over the entire plane of sheet-form substrate that includes mask cured at the mask curing part (15) through such vacuum film forming technologies as, for instance, a vacuum vapor deposition method, a sputtering method, and a CVD (Chemical Vapor Deposition), or a spin coating method.

[0020]
The mask release part (17) is structured of a pressure-sensitive adhesive roll (17A) and an opposed roll (17B); and mask pattern that is of resin is released off (lift off) from the sheet-form substrate (11) on which thin film is formed while passing between these pressure-sensitive adhesive roll (17A) and the opposed roll (17B). Furthermore, at this time, it is all right to use other methods, for instance, a method that rubs off resin with a squeeze, a method that peels off resin physically by blowing an etching gas to etch, or a method that burns off resin, or a chemical method that gasifies [resin] by dissolving in solvent.

[0021]
The post-processing part (18) is designed to apply post-processes on the sheet substrate (11) on which thin film pattern is formed such as an ozone cleaning process to remove residues, or an ion implantation process by a plasma base ion implantation (PBII) processing and the like.

[0022]
Then, method that is used to form fine thin film pattern with this thin film pattern forming device (10) is explained below in reference with attached Figures 2 and 3.

[0023]
First of all, at the mask forming part (14), the sheet-form substrate (11) (Figure 2 (A)) that is sent out from the feed roll (12) is coated with releasable resin (for instance, acryl resin) selectively to give 6 μm film thickness by using such printing techniques, for instance, an ink jet printing method as illustrated in the Figure 2 (B) to form a mask (21). The pattern of this mask (21) is set to be of negative-type with prescribed thin film pattern. The mask that is of this resin (21) is cured by heating at mask curing part (15) and becomes mask (21A) as illustrated in the Figure 2 (C). At the film forming part (16), thin film (22) with, for instance, 0.02 μm thickness is formed by, for instance, a vacuum vapor deposition method, over the entire plane of sheet-form substrate (11) that includes mask (21A) that is cured at the mask curing part (15) as illustrated in the Figure 3 (A). Regarding thin film (22) of this time, because thickness of the mask (21A) is thicker than that of the thin film (22), stepping is formed between the portion on the pattern of the mask (21A) and the pattern.

[0024]
After thin film (22) is formed, sheet-form substrate (11) is shifted to the mask release part (17), and mask (21A) is released by, for instance, a pressure-sensitive adhesive roll (17A) at this time as illustrated in the Figure 3 (B). Through this, thin film pattern (22A) that is negative-type against mask (21A) is formed. Then, after the sheet-form substrate (11) on which thin film pattern (22A) is formed is subjected to an ozone cleaning process and the like at the post-processing part (18), it is taken up on the take-up roll (13).

[0025]
As explained above, according to this implementation format, because it is designed to form said mask (21A) at the mask forming part (14) by using printing techniques such as an ink jet printing, a gravure printing, or an off-set printing and the like, it is possible to form a mask without using a process that exposes mask pattern against photoresist as in the conventional method. In addition, as these printing devices show a possible mass production capability, it is possible to carry out series of processes in a continuous manner including mask forming, film forming, etching, and mask removal by using said thin film pattern forming device (10). And therefore, it is possible to form fine thin film pattern showing several 10s nm or lower in a large area and in a large quantity to enable to carry out mass production of polymer semiconductors or organic EL elements by forming multiple layers of thin films.

[0026]
The first implementation format is explained above, and it is all right to change the sequence of above-explained mask forming process and thin film forming process. Example of that is explained below as second implementation format.

[0027]
[SECOND IMPLEMENTATION FORMAT]
Figure 4 illustrates a schematic structure of thin film pattern forming device (10A) that relates to the second implementation format of this invention. Furthermore, according to this implementation format, the identical component portions as those of the first implementation format are shown with identical codes and explanations for these are omitted, and explanation is provided only on the portions that are different.

[0028]
This thin film pattern forming device (10A) has arrangements of film forming part (16) between feed roll (12) and mask forming part (14), and at the same time, thin film etching part (19) between mask curing part (15) and mask release part (17). Other components are the same as those of first implementation format. That is to say, according to this implementation format, a thin film with prescribed film thickness is formed first, and mask is formed on this thin film through printing technologies, and patterning of thin film is conducted by etching this thin film using this mask. That process is explained more specifically in reference with Figure 5 and Figure 6.

[0029]
First of all, on the sheet-form substrate (11) (Figure 5 (A)) that is sent out from the feed roll (12), thin film (22) showing 0.03 μm film thickness is formed over the entire plane of said sheet-form substrate (11) by for instance, a vacuum vapor deposition method as illustrated in the Figure 5 (B). Then, as illustrated in the Figure 5 (C), at the mask forming part (14), releasable resin (for instance, acryl resin) is selectively coated at 3 μm film thickness through printing techniques, for instance, an ink jet printing method to form a mask (21). Patten of this mask (21) is set to be positive-type prescribed thin film pattern. As illustrated in the Figure 6 (A), this mask (21) is cured at the mask curing part (15) (mask (21A)).

[0030]
Then, as illustrated in the Figure 6 (B), etching is applied to the thin film (22) by using mask (21) at the thin film etching part (19) to form thin film pattern (22A). Regarding etching method, for instance, dry etching such as etching by oxygen radicals and the like is used. After thin film pattern (22A) is formed, sheet-form substrate (11) is shifted to the mask release part (17), and as illustrated in the Figure 6 (C), mask (21A) is released by, for instance, a pressure-sensitive adhesive roll (17A). Through this, thin film pattern (22A) that is of positive-type against mask (21A) is formed. Then, after said sheet-form substrate (11) is subjected to an ozone cleaning process and the like at post-processing part (18), it is taken-up on the take-up roll (13).

[0031]
According to this implementation format also, because it is designed to form a mask (21A) through use of printing techniques such as ink jet printing or an off-set printing at the mask forming part (14) in the same manner as explained in the first implementation format, it is also possible to form a mask without using such process as exposure of mask pattern against photoresist as in the conventional method to enable to form fine thin film pattern showing several 10sd or lower in a large area at a large quantity.

[0032]
Through repeat execution of thin film pattern forming method explained in above first implementation format and second implementation format, it is possible to prepare various devices showing a three-dimensional laminate structure. Example of preparation of organic EL display using the method by first and second implementation formats is explained below in reference with attached Figures 7 ~ 15. Furthermore, according to each Figures 7 ~ 14, (A) illustrates a plane view, (B) illustrates a cross sectional view in arrow direction of B-B of the (A).

[0033]
First of all, as illustrated in the Figures 8 (A), (B), a substrate, for instance, a transparent sheet-form plastic substrate (30) (Figures 7 (A), (B)) is readied, and electrode film (31), for instance, ITO (Indium Tin Oxide) film is formed on the plastic substrate (30). Then, as illustrated in the Figures 9 (A), (B), a mask is formed through coating an acryl resin in a stripe form by a printing technique, and then, this is irradiated with UV rays to cure (mask 32A).

[0034]
Then, as illustrated in the Figures 10 (A), (B), a gas comprising, for instance, tetrachloroethane ($C_2H_2CL_4$) and argon (Ar) is flown in to generate plasma, and electrode film (31) is selectively removed by using the mask (32A) to form electrode pattern (31A) of positive-type against mask (32A). Then, as illustrated in the Figures 11 (A), (B), mask (32A) is released from the plastic substrate (30).

[0035]
Then, as illustrated in the Figures 12 (A), (B), printing technique is used again to coat an acryl resin in the direction in a stripe form that is orthogonal to the stripe-form electrode pattern (31A) to form a mask, and then, it is continued to be irradiated with UV rays to cure the mask (mask 33A).

[0036]
Then, as illustrated in the Figures 13 (A), (B), (C), for instance, TPD (N,N'-diphenyl-N,N'-bis(3 methyl phenyl)-1,1'-biphenyl 4,4'-diamine), α-NPD (α-naphthyl phenyl diamine), tris(8-quinolilato)[transliteration] aluminium complex (tris(8-hydroxyquinoline)aluminium), Al(q_3), lithium fluoride (LiF), aluminium (Al) successfully to form a thin film (34). At this time, regarding the thin film (34), because thickness of the mask (33A) is thicker than the thin film (34), it shows stepping between the portion on the pattern of mask (33A) and portion of pattern. Furthermore, Figure 13 (C) shows a cross sectional view of Figure 13 (A) in arrow direction of C-C .

[0037]
Then, as illustrated in the Figures 14 (A), (B), (C), mask (33A) of acryl resin is released for instance with a squeegee. Through this, thin film pattern (34A) that is a negative-type against mask (33A) is formed. Lastly, an alumina (aluminium oxide) film (35) is formed over the entire plane of plastic substrate (30) through, for instance, a vapor deposition method. Furthermore, Figure 14 (C) illustrates a cross sectional view in arrow direction C-C of the Figure 14 (A). Through above-explained processes, as illustrated in the Figure 15, organic EL display (36) on which plural numbers organic EL elements (37) showing green mono-color emission are arranged in a matrix pattern form from the back plane of plastic substrate (30) can be prepared. Furthermore, Figure 15 illustrates a view from a back plane side of the plastic substrate (30) of this organic EL display (36).

[0038]
As explained above, because mask for thin film etching is formed through a printing technique of an ink jet method, it is possible to prepare organic EL display (36) over wide area in a large quantity to ease realization of electronic paper and the like.

[0039]
This invention is explained in reference with implementation formats above; however, this invention should not be limited to above-explained implementation formats; and various modifications are possible. For instance, according to above-explained implementation formats, an example of preparation of organic EL display (36) is explained as a specific example; and it is all right to prepare other device such as liquid crystal display and the like.

[0040]
[EFFECTS OF THIS INVENTION]
As explained above, according to this invention's thin film pattern forming method and thin film pattern forming device, because mask for thin film etching is formed by selectively coating on a flexible sheet-form substrate through printing technique using a releasable resin, it is possible to form fine thin film pattern showing several 10s nm or under over wide area in a large quantity; and through repeating that process, it is possible to manufacture flexible semiconductor device or electronic paper having three-dimensional structure over wide area in a large quantity.

[BRIEF DESCRIPTION OF THE FIGURES]
[FIGURE 1]
It illustrates a structural view of thin film pattern forming device that relates to the first implementation format of this invention.

[FIGURE 2]
It illustrates a cross sectional view that explains thin film pattern forming method by thin film pattern forming device that is illustrated in the Figure 1.

[FIGURE 3]
It illustrates a cross sectional view that explains processes that follow those illustrated in the Figure 2.

[FIGURE 4]
It illustrates a structural view of thin film pattern forming device that relates to the second implementation format of this invention.

[FIGURE 5]
It illustrates a cross sectional view that explains thin film pattern forming method by thin film pattern forming device that is illustrated in the Figure 4.

[FIGURE 6]
It illustrates a cross sectional view that explains processes that follow those illustrated in the Figure 5.

[FIGURE 7]
It illustrates process drawing that explains the method of preparing organic EL element.

[FIGURE 8]
It illustrates a process drawing that explains processes that follow those illustrated in the Figure 7.

[FIGURE 9]
It illustrates a process drawing that explains processes that follow those illustrated in the Figure 8.

[FIGURE 10]
It illustrates a process drawing that explains processes that follow those illustrated in the Figure 9.

[FIGURE 11]
It illustrates a process drawing that explains processes that follow those illustrated in the Figure 10.

[FIGURE 12]
It illustrates a process drawing that explains processes that follow those illustrated in the Figure 11.

[FIGURE 13]
It illustrates a process drawing that explains processes that follow those illustrated in the Figure 12.

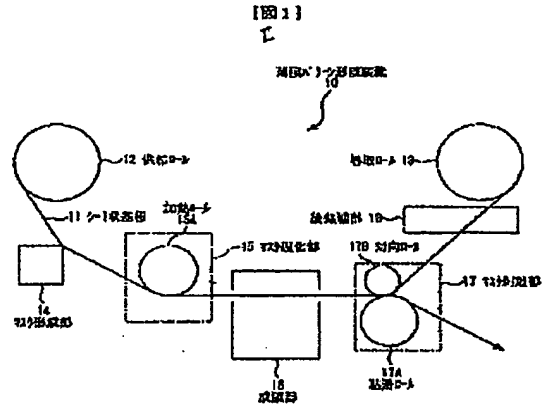
[FIGURE 14]
It illustrates a process drawing that explains processes that follow those illustrated in the Figure 13.

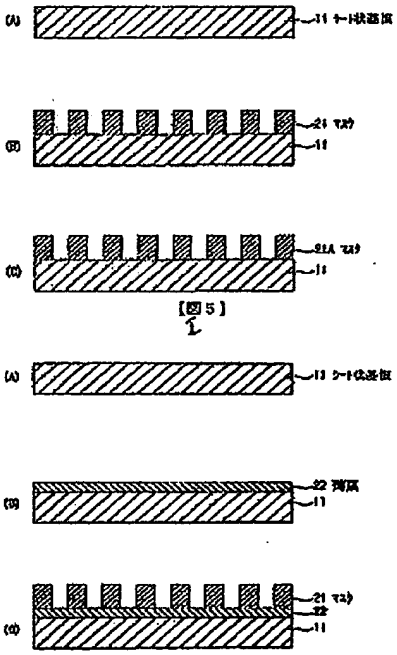
[FIGURE 15]
It illustrates a view that shows structure of display side of organic EL display.

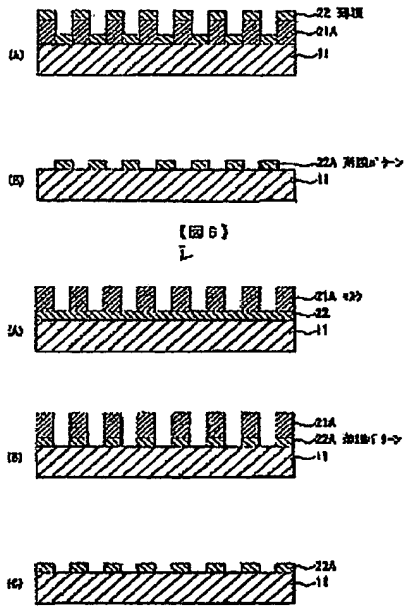
[DESCRIPTION OF CODES]
10, 10a : thin film pattern forming device, 11: sheet-form substrate, 12: feed roll, 13: take-up roll, 14: mask forming part, 15: mask curing part, 15A: heating roll, 16: film forming part, 17: mask release part, 17A: pressure sensitive-adhesive roll, 17B: opposed roll, 18: post-processing part, 19: thin film etching part, 21,21A, 32A, 33A: mask, 22,34: thin film, 22A, 34A: thin film pattern, 30: plastic substrate, 31: electrode film, 31A: electrode film pattern, 35: alumina film, 36: organic EL display, 37: organic EL element.

I: Figure

Figures 1 through 15







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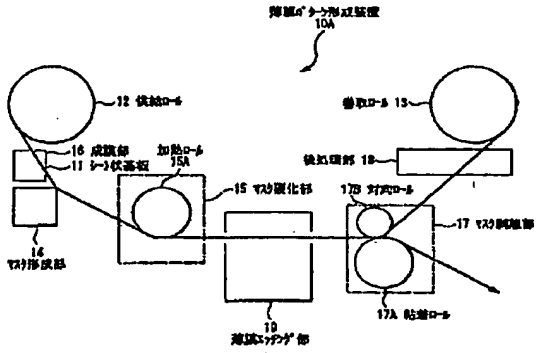

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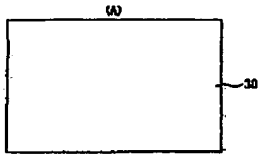

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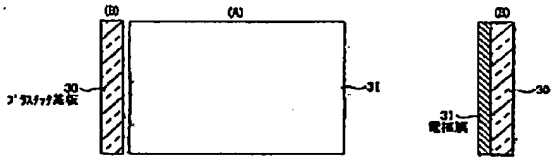

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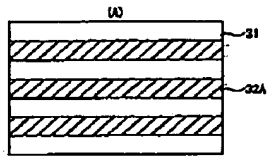

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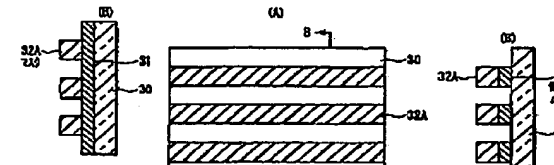
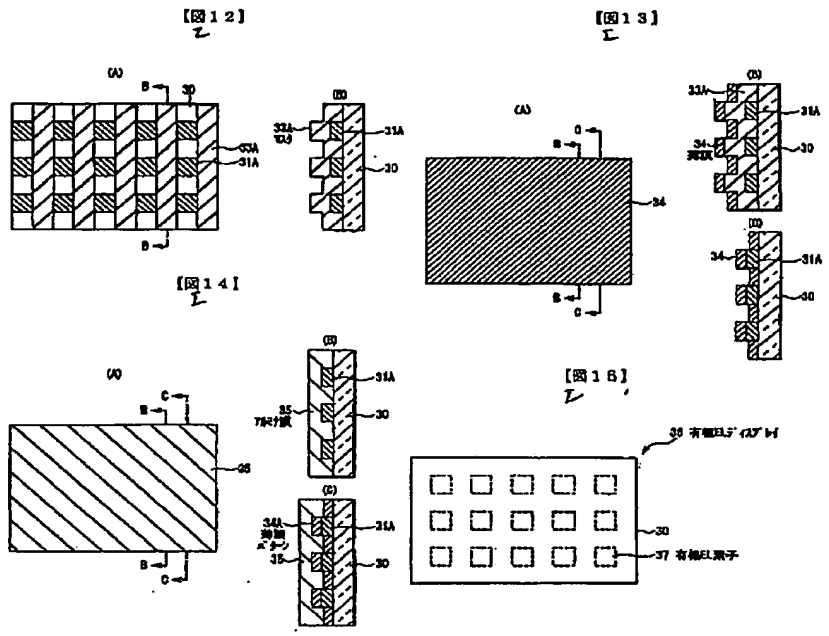


【図１１】



Translation requested by: Bobert V. Heiti
Translation by: Mie N. Arntson, 512-331-7167